DETECTIVES, NINJAS, AND THE TASTE OF MATH: ELEMENTARY TEACHERS' REASONING ABOUT MATHEMATICS CURRICULAR RESOURCES

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Teachers hold complex goals when making decisions about their curriculum. In particular, the proliferation of supplemental resources means teachers negotiate both how to use the adopted curriculum and how to supplement it with additional resources. Through a study of the language teachers use, the decision-making of three elementary classrooms is brought to life. This study highlights the unique curricular decisions each teacher makes within the context of their own classroom and reveals curricular decision-making themes that emerge across the teachers' classrooms.

Keywords: Teacher Beliefs, Curriculum, Elementary School Education

Objectives or Purposes of the Study

Language provides insight into how "we base our actions…on what we take to be true" (Lakoff & Johnson, 1980, p. 160) and teachers' stories provide insight into the multiple professional, personal, and practical experiences they bring to their classroom decision-making (Clandinin & Connelly, 1996). In this study, and in celebrating the theme of *Engaging All Learners*, we examine teachers' language and reasoning about the decisions they make when using multiple curricular resources to better understand their practice as mathematics teachers. These stories highlight the intention teachers have to deliver instruction that targets the learning needs and interests of their students and to bring a sense of joy into the mathematics classroom.

Research Question

What key words, lines of reasoning, and figurative language do elementary mathematics teachers use when explaining the decisions they make about using multiple curricular resources?

Perspective(s) or Theoretical Framework

Curricular Resources

Recently, online curricular resources have proliferated and there is growing evidence that teachers are making use of these resources widely (Pepin, et al., 2013; Sawyer et al., 2020). While many teachers continue to rely on textbooks to implement content and instructional strategies, districts vary in the quality and quantity of textbooks that are selected and the degree to which they are supported or mandated (Polikoff et al., 2020). Consequently, teachers have varying needs and supports for supplementing their curriculum. Rather than think about curriculum implementation in terms of fidelity to a textbook or singular resource (Brown et al., 2009; Superfine et al., 2015), it becomes important to investigate both the degree of teacher's curricular control, here defined as the degree to which teachers feel empowered to make decisions to meet their students' needs (Dampson et al., 2019), and the context of their decision making with respect to exploring their curricular options.

Silver (2022) systematically reviewed the literature surrounding the decisions teachers make as they supplement any officially adopted curriculum with additional curricular resources. One of the major findings of his review suggests that most teachers supplement their district- and

school-provided resources to meet goals specific to their instructional approach to the content, school context, and students' needs. Thus, most teachers have become curriculum "curators" for their classrooms (Hu et al., 2020), and their choices influence the mathematics experience and learning opportunities for their students. Given the pervasiveness of this trend, it is increasingly important to understand how teachers reason about their use of curricular resources.

Context of Ongoing Impacts from the COVID-19 Pandemic

An additional rationale for the importance of exploring teachers' decisions around curricular supplementation is that content, context, and student needs are likely to be impacted by teachers' need to be responsive to the impacts of the COVID-19 pandemic. It has been well documented that learning opportunities during COVID-19 emergency remote teaching and the subsequent return to classrooms varied widely, raising and exacerbating equity concerns and discussions of learning loss (Aguilera & Nightingale, 2020; Authors, 2021; Gross & Opalka, 2020; Grossman et al., 2021; Huck & Zhang, 2021; Reilly & Ball, 2020; Valant, 2020).

Methods or Modes of Inquiry

Participants

The data presented here focus on three teachers, whose self-chosen pseudonyms are Audrey, Kasie, and Jamie. Audrey is a second-grade teacher with six years of experience. Kasie is a third-grade teacher with 13 years of experience. Jamie is a fourth-grade teacher, also with 13 years of experience. All three teachers are generalists and teach across subject areas, but they all feel most confident and interested in teaching mathematics.

Context

All three teachers work in the same Midwestern elementary school. The school enrolls over 200 students. The population is racially diverse (37% White, 29% Black, 22% Hispanic, 11% multiracial) and economically disadvantaged (78%). Standardized test data suggest that the mathematics proficiency for elementary students (66%) is above the state average (48%).

The district provides a mathematics pacing guide with three-week windows focused on standards. Students take benchmark assessments at the end of each three weeks using an online application. Teachers reported having between 45 and 75 minutes to spend on mathematics each day, depending on the schedule for "specials" (e.g., music, art) with most days close to 60 and some days allowing up to an extra 30 minutes for mathematics intervention based on the previous benchmark assessment scores. The teachers reported using between 12 and 14 curricular resources for daily mathematics lesson planning.

At this school, face-to-face instruction resumed in Fall 2020, but learning was still disrupted throughout the past two years by shifts in best practice for COVID-19 mitigation (e.g., for spacing and orienting desks). These interviews took place in Spring 2022 and the teachers referenced and were responsive to challenges due to the COVID-19 pandemic, including some "unfinished learning" where students are not proficient at content from previous grade levels.

Data Collection

Data presented here are drawn from the two individual interviews. The first interview focused on identifying the mathematics curricular resources teachers used and the degree of autonomy teachers had in selecting and adapting their curricular resources. The second interview focused on the lesson planning process and examined how teachers created cohesive learning from the variety of resources they used. Consistent with Clandinin (2013), the interview design was intentional in that it allowed for us to explore teachers' lived experiences through telling, retelling, and reliving across interactions.

Analysis

The data presented here are based on audio recordings and transcriptions of the interviews. The transcriptions were de-identified through use of pseudonyms prior to being subjected to the descriptive/interpretative analysis by the researchers. Rather than analyze response by interview question, the two transcriptions from individual interviews with each teacher were analyzed holistically as a rich source of language and reasoning. Using Quinn's (2005) approach, three coders examined interview data to explore: (a) key words (e.g., repeated phrases, surprising word choices); (b) lines of reasoning (e.g., how teachers explain what they are doing); and (c) figurative language (e.g., metaphors) teachers used in explaining their decision making about use of curricular resources. No a priori codes were defined. Three researchers independently coded the interviews. All coding disagreements were resolved in discussions between the researchers.

Findings

Audrey

Key Words. For Audrey, the most repeated words/phrases had emotional valence (e.g., "love/don't really love/hate" [n = 26]). Other commonly repeated words and phrases focused on her student-centered approach (e.g., "meet their needs" and "where they are" [n = 23]) and her responsiveness to student ability and achievement levels (e.g., "high-ability"/ "high-achieving" and "lower groups"/ "lowest groups"/ "low-achieving" [n=16]).

Lines of Reasoning. Audrey depends upon a variety of supplemental curricular resources to "meet the needs" of her students. Her explanations of how and why she incorporates supplemental resources revolve around three major themes: accommodating wide variation in student learning levels, timing of her math block, and love for teaching and her students.

First, when discussing the desire to "meet the needs" of a range of achievement levels, Audrey describes her biggest challenge as having the "lowest" in the grade level and the "highest in the exact same room." In her words:

> I have nine IEPs this year, and I have three high ability students. And so, the majority of my IEPs are for a learning disability that ... the content is … well above where they are. And then, for my high ability students, the content is well below where they are … I have 26 students in my classroom, and that's a lot of students, all at a different level.

Audrey uses "the bare minimum" of her district's mandated curriculum, because it "is very hard to do independently" and not "grade-level appropriate." She reflects that "it would be easier if, maybe, I had access to the grade before, and their content, because then I could really help my kiddos that are struggling." She expresses the following frustration:

> It's supposed to meet them where they are, and it can meet some of my students who are above average pretty well, but any student that's on grade level or lower, it does not meet them.

She purposefully chooses supplemental materials that allow her to "access pre-k through 12th grade" content. She values the opportunity to differentiate discreetly and describes the following scenario:

> I will have a student that is high ability, that's very gifted at multiplication, and I can find that resource for them to push them farther. And I can do the exact same thing with my lowest

intervention group. I can put them on skip counting by twos. And, the thing I like about that is that none of the students know who's on what.

Second, Audrey also considers the timing of her math block. She describes the structure of her math block as "wonky" and "sporadic," with "those weird six or seven minutes at the beginning or at the end" due to the special area class schedules and feels "envious" that her co-teacher "has a wonderful, beautiful math block ... every day with no interruption for at least an hour." Audrey values supplemental electronic apps for those inconvenient spots of time (e.g., when there are "six minutes until the bell rings" and she gives students "the option of doing this, this or this" on a device).

Finally, Audrey makes the choice to manage multiple resources "honestly, for the comfort of" her students. Additionally, it is clear through a spontaneous self-reflection that experience has helped her navigate the complexities surrounding that management: "I have gained a lot of confidence in my teaching over the last few years. I'm very passionate about my kids. I'm there late. I'm there early. I love teaching."

Figurative Language. Figuratively, Audrey is resolved to sweeten the "taste" of math for students because she believes they are "burnt out" from textbook-heavy mathematics instruction in previous grades. This metaphor comes to life as she describes teaching graphing skills during a "Peep-themed" day:

> … yesterday, my entire day was Peep-themed because it's getting ready to be Easter. And so, I wanted to find graphing that related to Peeps, without me having to go and make it all, and there was perfect content. So, we had a taste test that we could graph, with all of the students, whose favorite Peep they got to eat... They were hyped up for it. They loved it.

Audrey reasons that "math could get very boring" if instruction is limited to "worksheets from the book" and reports that many of her students "hate math by the time they get to" her. She reasons that "if I want success, and I want my students to learn, I need to find a different way to do that." The idea of changing how mathematics tastes and making it "kid friendly" is repeated throughout her descriptions of teacher-created resources she finds online or creates herself. In addition to her "Peeps" day, her students collect data in an "Oreo" themed unit and participate in regular "parties" where math is paired with food and fun.

Kasie

Key Words. Similarly to Audrey, the most repeated words/phrases for Kasie were affective, with a focus on how students respond positively to curricular activities (e.g., "interest," "enjoy," "fun" [$n = 42$]). She also spoke often about curricular expectations and mandates (e.g., "standards" [$n = 22$]). Like Audrey, she worried about meeting the needs of her students, especially those who are the extremes of achievement in her classroom (e.g., students who "struggle" or "are frustrated" [$n = 12$] and those "higher" students who are "early finishers" [$n = 6$]).

Lines of Reasoning. Kasie explains her lesson planning process as first referring to the standards presented in the pacing guide, next accessing the curriculum provided by the district to teach them, and finally supplementing with other curricular resources only "as needed." The lines of reasoning she uses to rationalize incorporating supplemental resources revolve around two major themes. First, like Audrey, she discusses the need to engage "struggling" students while at the same time providing independent practice for "early finishers." Second, she talks

about the importance of consistency, and discusses the need to establish consistent "patterns" and "routines" for all students in her mathematics lessons.

In terms of meeting the needs of students at the extremes of achievement in her classroom, Kasie focuses mostly on engaging the students who "struggle" in mathematics. She has "a lot of students that have ADHD, or just struggle, in general are lower in math." Her strategy for supporting these students is to use an online educational marketplace to get materials for a "fun way to incorporate math" so students will "engage" and not feel "frustrated." Kasie knows, from teaching experience, the concepts that low-achieving "kids kind of zone out on." For example, with elapsed time, Kasie has found a supplemental detective-themed unit, in which elapsed time problems were integrated as clues for solving crimes around the world:

> But the fact that they were solving a crime and I made them detective badges and gave them magnifying glasses, and just those little extra things that the book doesn't do, or the other stuff that we have access to doesn't give them, made it more interesting for them. And I know that elapsed time is something that our students struggle with, so that was one that I wanted to definitely find something more engaging.

A second major reason Kasie sources supplemental curricular resources is to differentiate the independent practice her students do following whole class instruction. She works to maintain a balance between assigning things that are "too low" for students who would "breeze through it too quickly" and not "too high" or "too difficult," causing students to disengage. Since Kasie has access to different grade levels within an online program purchased by her district, she can either "push" her higher students or "go back a grade level or two" for students who need it. Kasie explains that the application provides "extra practice filler" for her "early finishers" and for students who "don't get to it," it "never counts against their grade."

Finally, Kasie recognizes that beyond learning the mathematics, students can struggle with interacting with multiple materials that present content differently than the textbook (e.g., "... it's more them struggling with figuring out how the program is working, not struggling to figure out the math"). She explains that:

> … it usually is harder the more and more you bring in because the kids get used to one kind of material, and then you throw other stuff at them. Sometimes they're more thrown off by the process of the material, instead of the actual process of the standard.

Because of this, she highlights the importance of establishing a "pattern" or "routine" when planning whole-class math lessons. Kasie describes how and why she chooses to "start with" the adopted curriculum for the "main teaching" of her lessons and then "branch out from there," when needed:

> … we usually follow the same kind of pattern. In the book, it starts with, ... they do a problem solving, and then we watch a video, and then we do some group problems together, then they do independent problems, and we check them. So, kind of following that same pattern. The kids know what to expect, then. Because that's how the material follows in the book.

Figurative Language. Figuratively, Kasie conceptualizes doing mathematics as slow and methodical problem-solving "detective" work. This metaphor comes to life when she describes what she enjoys most about teaching math: "... seeing the kids figure out those different ways of getting answers ... and their thought process through problem solving with it." Kasie values

building in time to explore strategies, pause videos for discussion, and encourage her students to collaborate while solving problems. She appreciates the problem-solving opportunities the adopted curriculum provides her students, saying "the kids seem to grasp on and be able to verbalize and talk about how they're getting their answers..." Finally, Kasie nurtures students' detective skills through engaging them in supplemental "puzzles," "riddles," and "brain teasers."

Jamie

Key Words. Because Jamie is an experienced interventionist, it is not surprising that "standards" is the word she used most frequently (n = 32) when talking about her curricular decision making. Like Audrey and Kasie, Jamie's transcripts are also full of affective and emotional word choices that describe both her own and her students' responses to curricular resources. Jamie's affective word choices (e.g., "enjoy", "like", "fun", "interest", "exciting" [n = 29]) are wholly positive and are especially prevalent when she describes her decision-making for the 30 minutes she has allotted for addressing remediation needs each day. Jamie also makes several references to curricular content in ways different than her peers (e.g., "vocabulary", "key concept" [n = 15]).

Lines of Reasoning. Jamie pays close attention to the pacing guide windows and standards she is required to cover in organizing her lessons by the week. She introduces a new concept on Monday, engages students in "small-group learning … centers" Tuesday through Thursday, and assesses student progress on Friday. The lines of reasoning she uses to explain how she incorporates supplemental resources revolve around three major themes: boosting student engagement, adapting instruction for differing levels of learning, and deepening her own understanding and experience with the standards.

First, Jamie is concerned with ensuring her students are engaged. For example, she uses a fall-themed project from an online educational marketplace to "review a bunch of different concepts" during intervention time and reports that "the kids enjoy it, because they're sitting there thinking about costumes and things like that, but you know, they're also doing math at the same time." When introducing new concepts, Jamie creates a chart or poster with students to support her instruction (e.g., drawing "a factor ninja" and talking "about how the factor ninja breaks up the number.") She does this because "it's something that helps the kids really learn or remember that concept; whereas, if you read it in the textbook, it's just, it's not as engaging … so that's why I tend to go more towards those things." She also elicits engagement by getting kids "up and moving," incorporating "current events type of things," and integrating the use of technology (e.g., using QR codes to "check their answers" on task cards that are spread around the room).

Second, Jamie's impetus for selecting supplemental resources is to adapt instruction for diverse learners in her classroom. Like Audrey and Kasie, she perceives her students to range widely in terms of achievement. Jamie identifies the students working above grade level as "high-flyers," those working on grade level as "gen-ed kids," and those with IEPs as having "different needs." Like Audrey and Kasie, Jamie values the online program purchased by her district, because she finds it very "adaptable." She loves that it "breaks standards down into little parts, and it also allows you to go back grade levels or go ahead grade levels. So, it really helps with differentiation, and adapting for every kid that you have in your room."

Finally, Jamie, like Audrey, is more likely to source alternative resources than use the provided curriculum because "when I look at all of these different places that I'm getting materials from, it helps me to broaden my look at the standard understanding." When using the district's materials, she thinks about the cost (e.g., feeling "guilty" for not using them) and

efficiency (e.g., using materials because "they're there"). However, she also believes that her experience across resources makes her a better teacher and more able to support her students:

> I actually think that it's beneficial for the teacher, especially, to be able to see the different materials and make the connections across those, because it gives you a broader view of what deeper understanding for the student looks like, and I see that as being beneficial … I like using different materials for that reason, that I can make sure that they truly understand and it's not just a surface-level understanding.

Figurative Language. Figuratively for Jamie, mathematics is envisioned as quick and efficient "ninja" work. She values "quick, concise videos … that just don't take a whole lot of time," anchor charts, and task cards sourced online. She implements speedy formative assessment routines (e.g., exit tickets and asking students to "jot down their answer really quick" on sticky notes). Finally, Jamie values the time-saving practice of following producers of high-quality materials on a social media platform over taking time for her own searches.

Discussion and/or Conclusions

Consistent with Silver (2022) and Hu et al. (2020), all three teachers in this study are engaged in extensive levels of curriculum supplementation and are acting as curriculum curators for their classrooms. Although it is clear that the three teachers featured in this study bring different professional, personal, and practical experiences to their curricular decision-making, several similarities emerge when looking across their reasoning for *why* they source supplemental curricular resources. Silver (2022) argued teachers make these decisions to meet goals specific to their instructional approach to the content, school context, and students' needs. This study provides support for all three sets of goals.

Most prevalent in the interviews, these three teachers endorse goals related to meeting student needs. They all used affective and emotional language throughout their interviews, especially when speaking about student engagement as well as student struggles and experiences of frustration. These teachers strongly emphasized student engagement as an important strategy for meeting the needs of underperforming students (Kasie, Jamie) and students who do not enjoy the content (Audrey).

Moreover, all three teachers speak about the unprecedentedly wide range of achievement they are currently experiencing in their school context and all three use supplemental resources to provide opportunities outside the range of what is expected by their adopted textbook. The teachers attributed this range in part as an effect of COVID-19 and "unfinished learning" at previous grade levels. Although not explicitly a focus of this study, it has emerged as a significant and interesting topic for future consideration.

In this study, goals associated with the school context included approaches for using the adopted curriculum versus when to supplement. For example, Kasie feels it is important to rely heavily on the adopted curriculum to establish routines while Jamie feels "guilty" for not using the adopted curriculum more, but also feels that she has become a better teacher by seeing the standards taught in different ways across resources. In contrast, Audrey is unapologetic about using "the bare minimum" of the adopted curriculum, believing that it does not do a good job of meeting her students' needs.

Finally, these teachers brought different supplementation goals related to the content, and specifically to how they envisioned mathematics and their role as mathematics teachers. These especially become clear in the figurative language used by each teacher with Audrey wanting to change the "taste" of math for her students, Kasie prioritizing problem solving "detective" skills, and Jamie looking for efficiencies and to build her student's "quickness" with math.

In conclusion, these findings bring teacher voice to researchers' understandings of the reasoning teachers bring to making decisions across multiple curricular resources. Additionally, they demonstrate that teachers working in the same school context can bring both similar and different goals to their use of curricular resources and teaching mathematics more generally. These findings emphasize the importance of closely attending to teachers' language and reasoning and the value of teacher voice in research.

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